shows, as do also the series of papers by various experts, which are now being published by the Royal Dublin Society, that the fauna is one of extreme interest. A marine biological laboratory is one of those institutions in which, beyond all question, the interests of pure science and its applications to industry and commerce are so interwoven that there need not be any hesitation in endowing and supporting it by the most "practical" minded individual or Government.

There is evidence in the shape of numerous misprints that the author produced the book under stress of time. The systematic zoologist has a right to complain of Mr. Saville-Kent's practice of naming imperfectly diagnosed genera and species. In hardly a single case is there an adequate description of a new species. Being himself a zoologist, he should have been more considerate to his colleagues.

It is difficult to criticise the sixteen coloured plates which conclude the volume. They contain over two hundred colour sketches, selected out of a much larger number from the author's note books. This being so, we may regard them as colour memoranda, taken on the spot and grouped as plates. Very few of them can be regarded as drawings of the animals, since, as a rule, the critical points of form are omitted. The reviewer has checked the colours of some of the animals depicted by sketches made by himself of the same species, and he finds that Mr. Saville-Kent's colouration, or rather the lithographer's rendering of it, is accurate enough, but there is no doubt that the plates are very crude. Inartistic as they are, they serve to emphasise the glorious fauna of the coral seas.

Alfred C. Haddon.

BACTERIOLOGY FOR THE PUBLIC.

A Manual of Bacteriology. By A. B. Griffiths, Ph.D., F.R.S.E., F.C.S. (Heinemann's Scientific Handbook Series). Small crown 8vo. Illustrated. (London: Heinemann, 1893.)

THE number of bacteriological text-books is still comparatively so small, that each successive endeavour to expound the principles of this new science attracts more general attention than is occasioned by the appearance of similar treatises in sciences which have already an abundance of such works in circulation. It might be supposed that because bacteriology is a science of such recent growth it would be more easy to prepare a text-book of bacteriology, than one dealing with a science the literature of which extends over a much longer period of time. As a matter of fact, however, this is by no means the case, for probably in no other experimental science has so much to be taken on trust, owing to the impossibility of repeating investigations under precisely similar conditions, as can be done in the case of physics and chemistry; whilst again from the very juvenility of the science of bacteriology, there has not yet been sufficient time and opportunity for many of even the most important points to be firmly established through repeated observation by different investigators. On this account there is the more scope for the exercise of the judgment and critical faculty by the author of a work on bacteriology, and we are of opinion that a heavy load of responsibility rests upon the shoulders of a writer who undertakes to present to the public a worthy treatise on this important subject.

It is doubtless an appreciation of this grave responsibility which has deterred many well-qualified persons both in this country and on the Continent from publishing works dealing with more than comparatively small portions of this elastic and comprehensive science. The writer of the work before us plunges confidently into the task before him without even a moment's misgiving or hesitation; his preface does not contain a word which might betray any fear that the pages which are to follow may fail to do justice to "the important and far-reaching subject of bacteriology." The table of contents indicates that the information to be imparted in this little book of 348 small crown octavo pages, which are well printed in clear large type, is to be of a most comprehensive character. We find first, an introductory chapter, upon which follow the "bacteriological laboratory and its fittings," "methods of cultivating, staining, and mounting microbes," "origin, classification, and identification of microbes," "biology of microbes," "infectious diseases and microbes," "microbes of the air," "microbes of the soil," "microbes of water," "ptomaïnes and soluble ferments,' and lastly "germicides and antiseptics." To deal with this extensive material in such a small compass obviously requires that a very careful selection should be made of the matter which is to hand, in connection with each of the above divisions of the subject. The method of selection to be adopted in such a case must of course depend upon the kind of reader for which the book is intended, but this is a point on which we are not informed in the text nor on which have we been able to arrive at any conclusion from a perusal of the pages. The idea that the book is designed for the general reader is negatived by the fact that there occur long catalogues of bacterial species and of bacterial products, together with technical details which can only serve to increase the chaotic bewilderment in which the minds of most persons find themselves with regard to the subject of micro-organisms in general. On the other hand, for the serious student of bacteriology the information is as inadequate when detail is essential as it is discursive and wandering when terseness and precision are required. The entire work bears the impress of the hasty and premature compilation of undigested reading. We come to this conclusion, as it is almost impossible to believe that the author is so ignorant as some of his statements would indicate. Thus it would be uncharitable to believe that the author had written the following passage except by oversight: "Microbes may be simply divided into aërobic and anaërobic forms. *Bacillus spinosus* and *Bacillus œdematis maligni* are examples of the former; while *Micrococcus candicans* and *Bacillus subtilis* are examples of the latter kind." We feel sure that Dr. Griffiths is as well aware as the most elementary student of bacteriology that the *Bacillus subtilis* is a type of the aërobic and the *Bacillus œdematis maligni* a type of the anaërobic microbe. In the special description of *Bacillus subtilis* which follows in a later chapter we should be interested to learn on what authority this organism is described as "the hay-fever microbe." The same paragraph furnishes another excellent illustration of the kind of loose illogical writing in which this book abounds; thus, it is stated that "the action of ozone on both the spores and bacilli is that they are completely

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destroyed; this fact explains the absence of this and other microbes in the air at sea—the latter containing an appreciable amount of ozone." Innumerable experiments have surely proved that the absence of microbes in sea-air would be anticipated on mechanical grounds quite irrespectively of the possible subsidiary effect of ozone.

We believe that Dr. Griffiths is primarily a chemist, and a number of pages in this work are devoted to the chemical products elaborated by micro-organisms; in this connection we are informed that yeasts secrete a soluble enzyme which converts maltose into dextrose and levulose (*sic*), nor is it easy to believe that this is a *lapsus plumæ*, for the equation is given with the explanatory names beneath the formulæ, thus

$$\underset{\text{[maltose]}}{C_{12}H_{22}O_{11}} + H_2O = \underset{\text{[dextrose]}}{C_6H_{12}O_6} + \underset{\text{[levulose]}}{C_6H_{12}O_6}.$$

Dr. Griffiths devotes a number of pages to the subject of hydrophobia, but in connection with the hitherto undiscovered vital cause of this malady we hardly think that either the public or the scientific world will feel much interest in the author's statement that he has "observed a micrococcus in the saliva of a woman suffering from hydrophobia," notwithstanding the categorical assurance which follows that "this microbe does not occur in healthy human saliva."

In dealing with the much-vexed subject of the etiology of pneumonia, the author refers only to the pneumococcus of Friedländer which has long been regarded as an ineligible candidate for the distinction of being the specific cause of this disease, whilst of the far more probable diplococcus of Fränkel there is no mention whatever, nor indeed of the uncertainty which surrounds the entire question.

Similarly, in connection with the bacillus of typhoid fever we find no mention of the closely-allied *Bacillus coli communis*, nor does the author appear to be acquainted with any of the modern methods which have been resorted to for its diagnosis, but contents himself with copying a long passage from Gaffky's original paper of 1886 in which the statement is made that the well-known potato-test serves to distinguish this microbe from all others. Indeed, the transcription of long passages from the works of other authors is a striking feature in this book, and inasmuch as such extracts are not printed in different type, the reader must be ever on the alert for the small inverted comma, in order to know whether he has before him the words of Dr. Griffiths or those of some more or less distinguished authority.

We do not think that any useful purpose would be served in pursuing this criticism further, nor should we have referred to as many points as we have done but that we have such strong reason to believe that the circulation of works of this kind among some sections of the public is fraught with no little danger. It is by no means uncommon for persons without any special qualification whatever, but with plenty of cheap assurance and a smattering of information gleaned from semi-popular works like the one before us, to perambulate the country under the auspices of county councils and other equally competent bodies, and to deliver discourses or even write books on sanitary and hygienic subjects; so that if the sources from which these retailers of third-hand knowledge draw are grievously inaccurate, it requires but little imagination to realise how serious may be the consequences.

THERMODYNAMICS.

Die Thermodynamik in der Chemie. Von J. J. van Laar. Mit einem Vorwort von Prof. Dr. J. H. van 't Hoff. Pp. xvi., and 196. (Amsterdam and Leipzig, 1893.)

TWENTY years ago the first application of the second law of thermodynamics to the study of chemical phenomena was published by Horstmann, and shortly afterwards the whole subject was investigated by Willard Gibbs, but in a manner so general that his work failed to gain the recognition of physical chemists for many years. Within the last decade, however, progress in this direction has been very rapid, and special branches or special aspects of chemical thermodynamics have received exhaustive treatment at the hands of van 't Hoff, Le Chatelier, Duhem, Planck, and others. But if we except the novel and brilliant exposition in the new edition of Ostwald's "Lehrbuch der allgemeinen Chemie," a general survey of the modern applications of thermodynamics to chemistry has hitherto been wanting, and it is to supply this want that Dr. van Laar has written the present volume.

The first half of the book is concerned with general thermodynamical principles and their application to the behaviour of gases and saturated vapours. The deviations from the laws of perfect gases are considered very fully—indeed, at inordinate length. As Prof. van 't Hoff says in his preface, the work is alternately text-book and memoir. Now, while this method of treatment may have its advantages, it entails an utter absence of balance between the various parts of the work. It appears, for instance, out of all proportion to devote a fifteenth part of the whole book to the discussion of the formula for the vapour pressure of a liquid. After making his way through thirteen pages of infinite series, differential equations, and determinants, the student finds that, when judiciously modified, van der Waals's equation can be made to express exactly the relationship between the temperature and pressure of a vapour in contact with its liquid—a result (to the chemist, at least) quite incommensurate with the trouble involved in arriving at it.

It is the second half of the work which is of special interest to students of physical chemistry. Beginning with the fundamental entropy principle of Gibbs, the author develops the various equilibrium equations, and gives a general proof of the important relation $d \log K/dT = Q/RT^2$. Then come applications to concrete cases of dissociation and balanced action. The "temperature of transformation" of phases of constant composition and the "triple point" are next fully discussed, and the last portion of the book is occupied with the behaviour of dilute solutions. Here the new theories of osmotic pressure and electrolytic dissociation are viewed from the thermodynamical standpoint, many important constants being calculated afresh. The depression of the freezing point and of the vapour pressure in solutions, as well as the question of affinity constants, all receive ade-

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